REMARKS/ARGUMENTS

Claims 1 to 18 are now pending in the current application. Claims 1 to 12 have been amended, and claims 13 to 18 have been added. The amendments and new claims find full support in the specification and drawings.

The Examiner rejected claims 1 to 12 under 35 U.S.C. §101 as lacking a clear utility, and in a related rejection under 35 U.S.C. §112, first paragraph, as lacking support given the lack of a clear utility. Applicants strongly traverse these rejections.

Applicant has amended the claims and specification to more clearly recite the nature of the phenomenon being measured by the apparatus of the current invention and the utility of such measurements. For example, applicants have clarified the nature of the time being measured as being the "centroid time" instead of the more general term "tunneling time". This amendment also reflected in amended Figure 8. Support for this amendment can be found in the specification at page 15, lines 1 to 15, and the values recited in Table 3.

Applicant has also amended the specification to more consistently recited that it is the wavefront that is selected by the apparatus, not necessarily the high energy portion of the wavepacket. Applicant had previously used these terms interchangeably and it is believed this use of terminology might have led to some confusion.

Finally, Applicant has also removed some of the embodiments of the invention, such as the use of the apparatus as a speedometer in light of the Examiner's comments and the results

of some additional experiments conducted by Applicant. It is believed that the remaining embodiments of the invention, directed as they are to a cosmic compass for determining the direction of the cosmic microwave background Doppler redshift, have utility and are fully supported both theoretically and experimentally by the disclosure provided in the specification. However, because the Examiner has called into question the theoretical underpinnings of Applicant's apparatus, and indeed, questions the data itself, Applicant provides thé following tutorial on the working of the apparatus and the physical theories upon which its operation is based.

> In the current invention the superluminal group velocity and the average speed of energy flow of photon wavepackets is measured for two-meter wavelength photons tunneling through a water mirror. The advantage of using long wavelength photons, as opposed to the optical or short wavelength photons used in the prior art, is that one is able to measure the small sidereal effects that are the one-way superluminal group and subluminal phase velocities of light that scale with the wavelength. The sidereal one-way, superluminal group velocity was first predicted by Reichenbach as the relativity of simultaneity for superluminal energy flow [[1] H. Reichenbach, The Direction of time, M. Reichenbach Editor, Dover Publications, Mineola NY 1999]. Changing Shannon entropy with renormalization group flow as described by Fujikawa [[2] K. Fujikawa, "Remarks an Shannon's Statistical Inference and the Second Law in Quantum Statistical Mechanics", arXiv:cond-mat/0005496 v4 1 Apr 2002] in turn causes the subluminal phase velocity to be sidereal.
>
> Accordingly, the electromagnetic pulse energy arrival time and group velocity only involves the Poynting vector and is given by the time expectation integral over the incoming Poynting flux. The energy arrival time is defined as the time "center of mass" and is suitable for describing the energetic classical electromagnetic pulses used here.

The complex part of the index of refraction is small and the measured group delay involves only the real part of the index of refraction as described by Peatross, Glasgow, and Ware [[3] J. Peatross, S. A. Glasgow, and M. Ware, "Average Energy Flow of Optical Pulses in Dispersive Media", Phys. Rev. Lett. **84**, 2370 (2000)]. In summary, the classical electromagnetic superluminal energy pulse cannot get past its luminal wavefront and is superluminal only inside the wavepacket as described by Chiao [[4] R. Y. Chiao, "Tunneling Times and Superluminality: a Tutorial", arXiv:quant-ph/ 9811019, 7 Nov 1998], and the sidereal velocities of light are statistical and do not exist near the wavefront as previously measured and as described by Will [[5] C. Will, "Clock synchronization and isotropy of the one-way speed of light", Phys. Rev. D **45**, 403 (1992)].

It is generally interpreted that the superluminal energy flow only exists to "pay back" energy borrowed from the vacuum. Photons do not self interact, and require optical coatings (the water mirror in this experiment) to form quasi-photons. The quasi-photons exist for a tunneling time ($\Delta\tau$) defined by Heisenberg's time-energy uncertainty principle ($\Delta\tau\Delta E \geq \hbar/2$), as described by Chiao [4]. In such quasi-photons the quasi-photon energy (ΔE) is equal to the Nyquist energy ($\Delta E = \hbar/\Delta\Delta\tau$) where the bandlimit time ($\Delta\Delta\tau$) is defined by Shannon's statistical uncertainty principle ($\Delta E \leq 4\pi\hbar/\Delta\Delta\tau$) as described by Fujikawa [2]. The measured bandlimit time ($\Delta\Delta\tau$), in turn equals the measured formal standard deviation ($\tau_p(std)$) in the energy peaking time (τ_p), and the bandlimit time is the minimum lower bound in the peaking time formal standard deviation as described by Kempf [[6] A. Kempf, "Fields over Unsharp Coordinates", Phys. Rev. Lett. **85**, 2873 (2000)] and defined by Equation 3 in the specification. Meanwhile, the measured causal and unitary superluminal energy flow is the renormalization group statistical continuation of Maxwell's equations as described by Delamotte [[7] B. Delamotte, "A hint of renormalization", arXiv:hep-th/0212049 v2, 27 Jan 2003].

In one embodiment of the current invention the tunnel is a Bragg mirror constructed with two water tanks separated by an air-gap. The air-gap length is adjusted to the minimum Poynting vector, defining a Bragg mirror as

shown in Figure 2', below, and as shown in Figure 3 in the application. The water layer thickness in each tank is one-half inch. The water tanks are constructed with quarter inch thick Plexiglas and are 4 feet wide (along the folded dipole direction) and two feet high. The water tanks are separated by an air-gap shown for convenience in Figure 1', below. This embodiment of the cosmic compass setup is also shown in Figure 1 in the application.

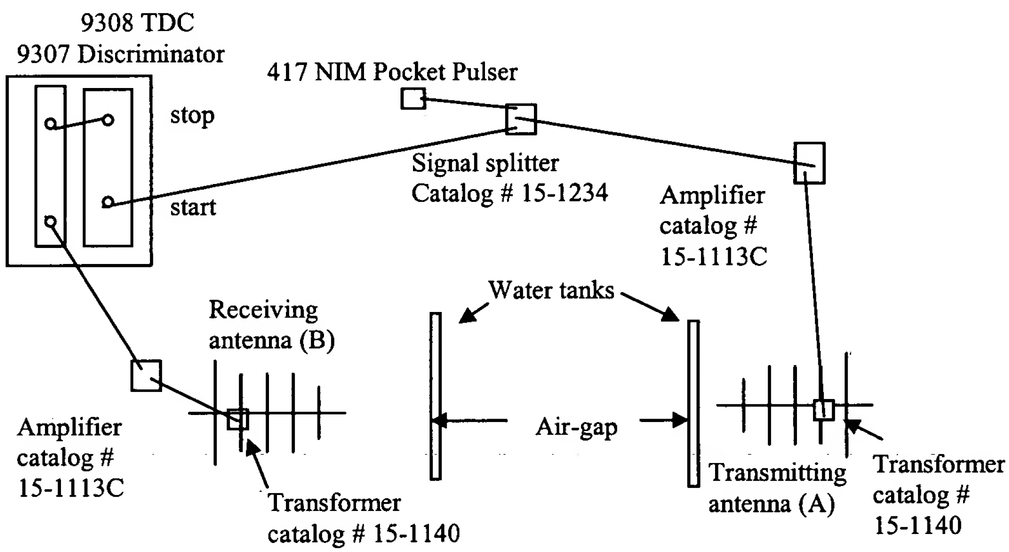

Figure 1': experiment setup showing part numbers.

During operation of the apparatus a pulser signal is split into two cables. The one leading directly to the Time to Digital Converter (TDC) is used to start the TDC. The other cable leads, through an amplifier, to the transmitting antenna. The transmitting and receiving antennas are identical five-element folded-dipole Yagi antennas designed for two-meter wavelength radio waves. Each antenna is surrounded by aluminum screen except for openings at the antenna ends that are 114 cm wide (along the folded dipole direction), bandlimiting the wavepacket. This opening is slightly smaller than the 122 cm or 4 feet wide water tanks. The transmitter and receiver folded-dipoles are held fixed at 4.9 meters apart.

For the experiments conducted to obtain the data used in the current tutorial, the TDC is a 9308 Picosecond Time

Analyzer preceded by a 9307 pico-Timing Discriminator (before the stop TDC input) from ORTEC™. The pulser is a battery powered Phillips Scientific™ Model 417 NIM Pocket Pulser. The transmitting and receiving amplifiers are from RadioShack™ catalog number 15-1113C. The pulser is connected through a signal splitter, catalog number 15-1234, to the input of the transmitting amplifier. 300-ohm to 75-ohm transformers, catalog number 15-1140, connect to 75-ohm cables at the antennas. The cable lengths are adjusted so that the pulser TDC start pulse arrives at the TDC just prior to the wavepacket fronts. This process is described in the specification and shown in Figure 2 in the application.

The classical superluminal electromagnetic group velocity theory that is experimentally demonstrated here, and the history of superluminal group velocity measurements are described by Peatross et. al. [3]. In this theory, the classical superluminal electromagnetic pulse energy arrival time only involves the Poynting vector and is given by the time expectation integral over the incoming Poynting flux. The energy arrival time used for describing the classical electromagnetic pulses used in this experiment is defined by the time-center-of-mass as described by Peatross et. al. [3]. Accordingly, the average classical energy arrival time or time-center-of-mass of (n) voltage peaks in each wavepacket is given by,

$$\tau_P \pm \tau_P(std) = \sum_{k=1}^{n} t_k S_k \Big/ \sum_{k=1}^{n} S_k \pm \tau_P \sqrt{2\left(\sum_{k=1}^{n} s_k \Big/ \sum_{k=1}^{n} S_k\right)^2} \qquad (1')$$

where (τ_p) is the energy peaking time (S_k) is the Poynting vector of voltage peak (k), (s_k) is the Poynting vector formal (*std*) standard deviation, and (t_k) is the voltage peak's centroid computed using a Gaussian fit to a single peak (k) in the spectrum. It will be observed that the classical energy peaking time (τ_p) defines the photon group velocity. The classical energy peaking time (τ_p) is also given by a Gaussian fit to all of the (n) peaks in a spectrum as shown in Figure 6 in the application.

In the experiments conducted, the arrival time difference between the tunneled wavepacket and the pulser is histogrammed by the TDC. Arrival time histograms measuring the voltage peak centroid times (t_k) and the number of counts under each peak (S_k) are collected in 1.6 minutes and 10 histograms are used to compute the formal mean and standard deviation values shown in the data plots. The TDC has a histogramming bin width of 1.22 ps over an 80 ns window. There are 1E6 start and stop counts in each TDC spectrum, except for the calibration data shown in Figure 2'.

Figure 3 in the application also calibrates the cosmic compass by showing the minimum transmitted energy at superluminal tunneling air-gap lengths. The 9307 discriminator level is set above the noise but low enough so that every start count has a valid stop count for all data except the calibration data shown in both Figure 2', below, and also in Figure 3 in the application.

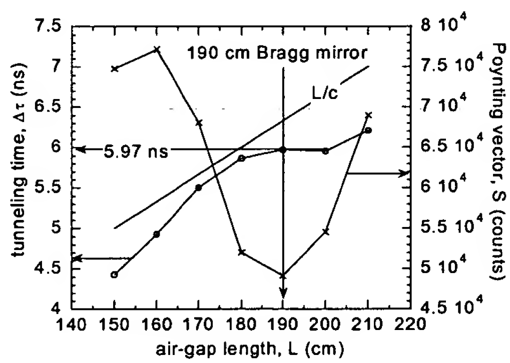

Figure 2': The *L/c* free photon time and the 2002 data tunneling time calibration of *5.97 ns* in a Bragg mirror at *L = 190 cm*. This Figure is the re-calibration equivalent to Figure 3 in the patent.

The measured peaking time difference ($\tau_g = \tau_p - (\tau_p)_{FREE}$) is defined as the measured group delay time (τ_g). The measured tunneling time is ($\Delta\tau = (L/c) + \tau_g$) where, ($L/c$) is the free photon time that is measured with both the water tanks removed and L is the air-gap length as described by Chiao [4] and by Equations 4 and 5 in the specification. The source time line shown in Figure 3 in the application has only the water tank nearest the receiver removed. If the water tank nearest the source were also removed, the

peaking time (τ_p) shown as the Gaussian fit to the source wavepacket shown in Figure 6 in the application, and given in Table 2 in the specification, would be advanced by the phase delay in passing through the source water tank.

For example, a measured tunneling time of 5.97 ns is shown in Figure 2'. This Figure 2' is the re-calibration equivalent to the 5.73 ns given in Table 2 in the specification at L = 220 cm and shown in Figure 3 in the application. To calibrate the detector system it is necessary to find where the tunneling time is independent of the air-gap length. This happens at the minimum in the Poynting vector at an air-gap length of 190 cm as shown in Figure 2' and at L = 220 cm shown in Figure 3 in the application, and given in Table 2 in the specification.

The cosmic rest frame (Rest Frame = RF) velocity vector is in the direction opposite the Earth's motion that causes the cosmic-microwave-background Doppler redshift. The Cosmic rest frame velocity is $\beta(RF) = 0.001237 \pm 0.000002$ and is a vector that points in the direction of right ascension of 23.20h and declination of 7.22°, the cosmic microwave background Doppler redshift direction as described by Fixsen [[8] D. Fixsen et. al., Astrophys. J. **473**, 576 (1996)] and Hagiwara [[9] K. Hagiwara et. al., Phys Rev D **66**, 010001 (2002), Sec. 22.3.1 the dipole (see, URL:http://pdg.lbl.gov)].

As shown in Figure 3', there are three peaks (n=3) in each TDC spectrum in the April and May data sets in 2002 and four peaks (n=4) in the November 2002 data set. The tunneling direction is parallel to the Earth's surface with an azimuth of 80° in Vancouver, Washington. Once per day the Earth's spin rotates the tunneling direction into the cosmic-microwave-background Doppler redshift direction. This direction equivalence between the photon propagation direction through the tunnel and the cosmic-microwave-background Doppler redshift direction happens once per day and the time of this equivalence is sidereal and changes by about four minutes per day and moves around the clock as the Earth moves around the Sun. Although the data shown in Figure 8 in the application does not show tunneling exactly into the redshift direction because the tunneling direction used in the apparatus shown in the application only comes

within 28° of the redshift direction once per day, it does show the expected oscillation.

For the measured tunneling time of $\Delta\tau$ = 5.97 ns, shown in Figure 2', and the non-relativistic velocity vector addition, the tunneling time sidereal oscillation would be $\Delta\tau$ = 5970 ±7.38 ±0.59 ps. The ±7.38 ps is the daily sidereal oscillation caused by the Earth's spin rotating the tunneling photons propagation direction into, and out of, the cosmic-microwave-background Doppler redshift direction, and the ±0.59 ps is the yearly change in the daily oscillation due to the Earth's velocity around the sun. This non-relativistic sidereal oscillation is equivalent to the 5730 ± 7.08 ± 0.57 ps for the tunneling time measured in the specification of 5.73 ns and for a tunneling direction that did not miss the redshift direction by 28° once each day, but that would be tunneling directly into the cosmic microwave background Doppler redshift direction.

Photon energy, defined by the average centroid time ($t_E = (t_n - t_1)/(n - 1)$) for (n) peaks in the TDC spectrum, is not sidereal. This time defines the average time between voltage peaks in the tunneled wavepacket and is plotted in Figure 3', showing that photon energy is not sidereal and only changes with temperature. The photon energy time shown in Figure 3' is ($(t_4-t_1)/3$) because the November 2002 data have four peaks in each TDC spectrum. The temperature is taken every 96 seconds and ten data points are used to compute the formal mean and standard deviation temperature values shown. The November 2002 experiment was engineered to have four peaks in each TDC spectrum to test the wavepacket energy equation ($t_E = (t_n - t_1)/(n - 1)$) for ($n > 3$) peaks in the TDC spectrum. The November 2002 experiment produced 4 peaks in each TDC spectrum by lowering the 9307 discriminator level.

If we assume that tunneling photon energy is isotropic in the cosmic rest frame, defined by zero Doppler shift in the cosmic microwave background, then the tunneling photon's energy time (t_E) might have been the group velocity time and have a measurable sidereal oscillation of ($t_E = t_E$(average) ±7.38 ± 0.59 ps) or (±7.08 ± 0.57) ps for the patent tunneling time. The measured

tunneling photon energy is not sidereal as shown in Figure 3'.

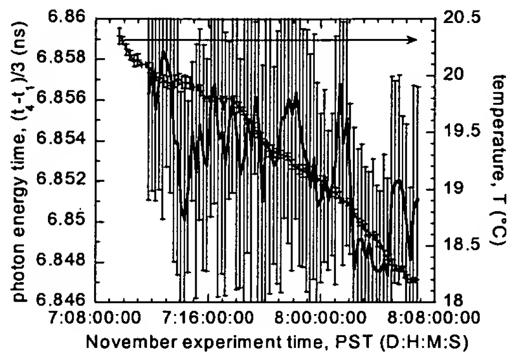

Figure 3': November 2002 photon energy time showing that photon energy is not sidereal and only changes with temperature.

Applicant discovered that the photon group velocity, defined using the peaking time given by Equation 1 and by using the Gaussian fit to the tunneling wavepacket shown in Figure 6 in the application, is sidereal. Specifically, the peak Poynting vectors, defined as the number of counts under each peak, are sidereal. When the tunneling-photon propagation direction is into the cosmic-microwave-background Doppler redshift direction, there are the most counts under the first peak in the TDC spectrum and the least counts under the last peak. The first peak is shown in Figure 4', with a centroid time of 45 ns and the last peak with a centroid time of 59 ns. As the tunneling direction rotates out of the redshift direction, the number of counts under the first peak decreases and the number of counts under the last peak increases.

The centroid times measure the tunneling photon phase velocity and only change as a function of temperature and Shannon entropy. The photon energy time shown in Figure 3' is parameterized by the centroid times shown in Figure 4'. For example, the centroid time of the largest peak in the TDC spectrum is shown in Figure 8 in the application and the counting statistics for this peak are given in Table 3 in the specification.

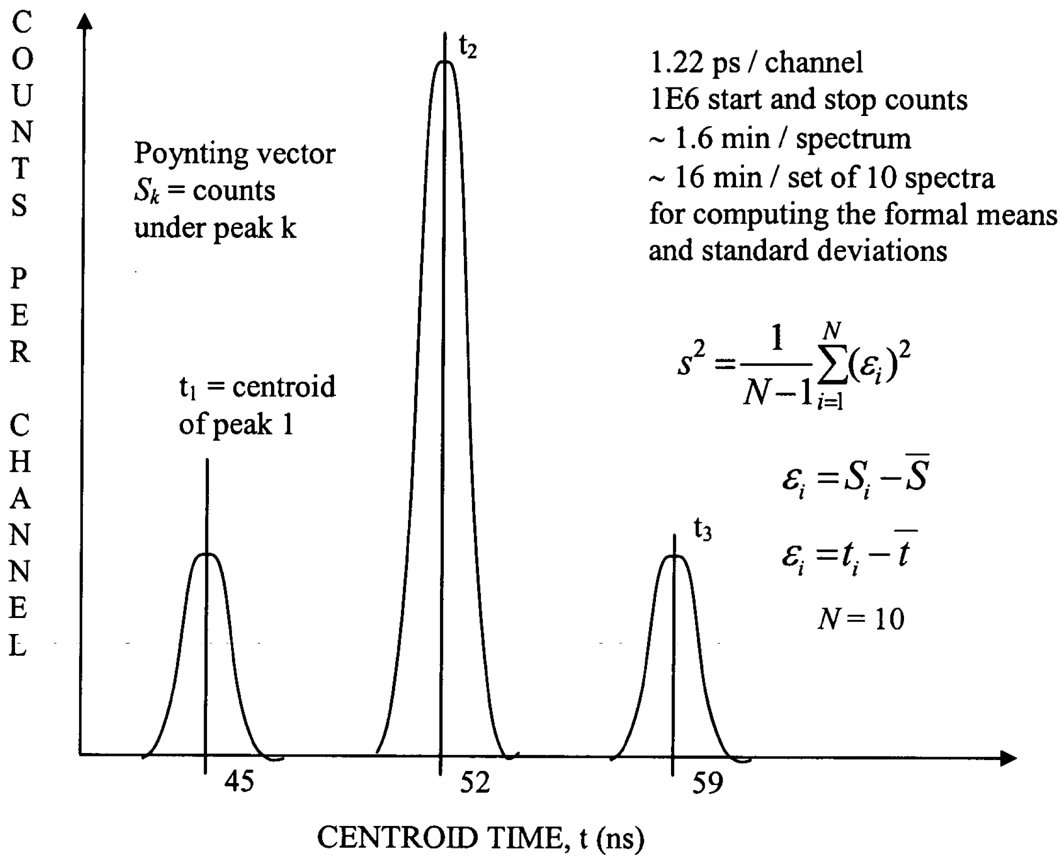

Figure 4': A drawing of a TDC spectrum showing Gaussian fits to each of the three peaks in the spectrum, the centroids (t_k) of the fits, the Poynting vectors (S_k) as the number of counts under peak k, and the formal standard deviation Equations. The peaks are drawn 7 ns apart because the photon wavelength is 2 meters.

For the 2002 data with three peaks in each TDC spectrum, the measured unequal spacing between the peaks is the bandlimit time $\Delta\Delta\tau = 2[(t_2 - t_1) - (t_3 - t_2)]$. The second and third peaks have the smallest separation between their centroid times because this experiment was engineered so that the highest energy wavepacket component would be near the wavepacket tail. The embodiment of the apparatus described in the application was engineered to have the

highest energy wavepacket components near the wavepacket front as given in Table 1 in the specification and shown in Figure 2 for the source wavepacket in the application. This was done in order to produce the data shown in Figures 4 and 5 in the application that are defined by Equations 6, 7, and 8 in the specification. The head-start definition of superluminal energy flow was inspired by the Clifford algebra definition of superluminal electron tunneling as described by Lasenby, Gull, and Doran [[10] A. Lasenby, S. Gull, and C. Doran, "STA and the Interpretation of Quantum Mechanics", Chapter 11 in Clifford (Geometric) Algebras, W. E. Baylis, Editor, Birkhauser, Boston, 1996].

The maximum bandlimit time is the peaking time standard deviation defined in Equation 1', above and given in Table 2 in the specification. At the maximum Shannon entropy we discover that the bandlimit time is the minimum lower bound in the peaking-time formal standard deviation as shown in Figure 6', below. The 2002 experiment was engineered to have the highest energy wavepacket component near the wavepacket tail in order to prove Peatross et. al. theory [3], which states that it does not mater if the highest energy component is near the wavefront or near the wavepacket tail. The 2002 experiment was operated with a minimum gain setting on both Amplifiers (catalog # 15-1113C shown in Figure 1'), and the amplifiers in the current application are also run at minimum gain.

As discussed above, the tunneling time, shown in Figure 5', detects a direction in space that is equivalent to the cosmic-microwave-background Doppler redshift direction. The Doppler redshift is caused by the Earth's velocity relative to the cosmic-microwave-background rest frame. When the tunneling direction is opposite to the Earth's cosmic velocity the tunneling time is minimum.

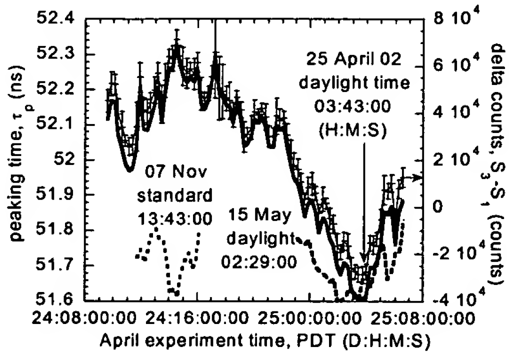

Figure 5': Peaking time sidereal oscillation 2002 minimums on April 25 (solid line), May 15 (dashed line), and November 7 (dotted line), are shown. Computed redshift direction standard and daylight times are shown. The April delta counts standard deviation is shown, exposing the sidereal physics. The November and May data are normalized to a 51.6 ns minimum peaking time. The data prove the cosmic compass technology claimed in the patent. The data are sidereal.

Sidereal peaking time 2002 minimums are shown in Figure 5', above. The April computed redshift direction time, at 25:03:43:00 (D:H:M:S) Pacific Daylight Time (PDT), is the time that tunneling is into the cosmic-microwave-background Doppler redshift direction on April 25, 2002. The measured minimums in the peaking times are at the computed redshift times as shown in Figure 5', thus proving the cosmic compass technology claimed in the patent by measuring the redshift direction move. The computed redshift times, and therefore the minimum tunneling-time directions, are sidereal, in that they move around the clock, by about 4 minutes per day, as the Earth moves around the sun. The direction that is detected by the tunneling time minimums is always the same direction, and is equivalent to the cosmic-microwave-background Doppler redshift direction.

The difference in the counts under the first and third peaks is shown in Figure 5' as delta counts. The standard deviation in the delta counts data is smaller than the peaking-time standard-deviation, showing that the peaking-time sidereal-oscillation is caused by a redistribution in counts under the first and third peaks for the April data set. The large peaking-time standard-deviation suggests that it is made large by a minimum-lower-bound as described by Kempf [6] and given by Equation 3 in the specification.

The 0.6 ns sidereal oscillation amplitude, shown in Figure 5' for the April peaking time, is equal to the ± 0.3 ns bandlimit time shown in Figure 6', below. The bandlimit time equals the peaking time standard deviation ($\tau_p(std)$) shown in Figure 6' and computed using Equation 1', given above. The centroid time standard deviations, $t_k(std)$, are only a few ps and are ignored in the Equation 1' ($\tau_p(std)$) computation, such peaking time standard deviations ($\tau_p(std)$) are given in Table 2 in the specification and are computed by measuring the peaking time five times at each air-gap

length. The peaking times are computed in the patent by Gaussian fits to the wavepackets as shown in Figure 6 in the specification.

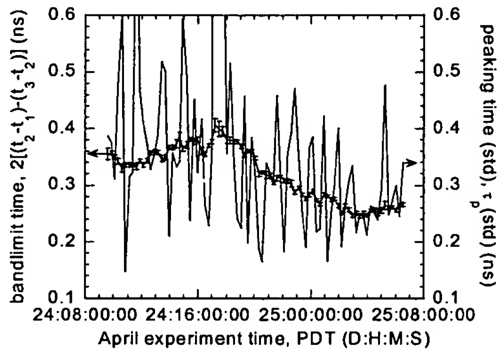

Figure 6': April 25, 2002 data showing peaking time standard deviation equivalence to the bandlimit time. The equivalence is understood as a minimum-lower-bound in the peaking-time standard-deviation. The sidereal amplitude of 0.6 ns in the April data shown in Figure 5 above is equal to the ±0.3 ns bandlimit time shown in this Figure.

The bandlimit time shown in Figure 6', above, is parameterized by the centroid time and is minimum when tunneling is into the cosmic-microwave-background Doppler redshift direction. The centroid time shown in Figure 8 in the application is also minimum (around the fit line) near the redshift time. Moreover, the statistics given in Table 3 in the specification and shown in Figure 8 in the application, and in Figure 3', show that cosmic compass technology is capable of probing the very short picosecond time required by Reichenbach [1] for two meter wavelength photons. As pointed out by the Examiner, shorter photon wavelengths would require shorter, sub-picosecond, measurements, however, these are not implicated in the current apparatus.

The superluminal tunneling time (group velocity) sidereal oscillation, shown in Figure 5', is defined using the Reichenbach coefficients (ε_C) that are defined as ($\varepsilon(AB)$) in Equations 1 and 2 in the specification,

$$\Delta\tau \pm \Delta\Delta\tau = 2\varepsilon_C\Delta\tau \pm \textit{counting statistics} \qquad (2')$$

where the Reichenbach coefficients are independent of the amplitude of Earth's absolute velocity through the cosmos.

The sidereal tunneling time amplitude saturates the minimum-lower-bound in its own formal standard deviation ($\tau_p(std)$) shown in Figure 6', and is not equal to the Earth's cosmic-microwave-background velocity amplitude, preserving Einstein's relativity principle. However, as shown and discussed above the direction in space is detected even though the amplitude of the sidereal oscillation is engineered using the bandlimit time. Accordingly, solving Equation 2' for the Reichenbach coefficients yields,

$$\varepsilon_C = \frac{1}{2} - \frac{\Delta\Delta\tau}{2\Delta\tau}(\vec{n}_C \bullet \vec{n}_T) \tag{3'}$$

where ($\Delta\Delta\tau$) is the bandlimit time defined above, (n_C) is a unit vector in the Cosmic-redshift direction, and (n_T) is a unit vector in the Tunneling direction. Accordingly, it has been shown that the Reichenbach coefficients define the relativity of simultaneity as defined in reference [1].

From the data and theory provided in the above tutorial Applicant respectfully submits that there is more than ample evidence that the theory behind an apparatus capable of measuring the Reichenbach coefficients is fundamentally sound, and that the claimed apparatus does indeed have the capability to measure the *group* velocity of light, that this *group* velocity is sidereal, and that this *group* velocity can be used to determine the tunneling time of a wavepacket.

In turn, Applicant shows that by observing the fluctuations in the tunneling time of the transmitted wavepackets over a period of time using the apparatus described herein that it is possible to determine the direction of the cosmic microwave background Doppler redshift. Accordingly, the apparatus can be

used as a cosmic compass to determine the direction of the observer to the redshift, and in turn by relating the fixed compass direction to the Earth's motion it is possible to use the apparatus as both a clock and a calendar.

Accordingly, Applicant respectfully submits that utility of the apparatus, as claimed by Applicant has been both well-established and sufficiently described by both the theoretical discussion and the actual data supplied in the filed specification, and respectfully requests withdrawal of this grounds of rejection. If the Examiner persists with rejections under 35 U.S.C. §101 or §112, paragraph 1, on these grounds, Applicant respectfully requests that the Examiner point out with particularity why the theoretical underpinnings and the provided experimental data are not sufficient under the MPEP.

The Examiner also rejected claims 1 to 12 under 35 U.S.C. §102(b) or §103(a), as being either anticipated by or unpatentable over Chiao ("Tunneling Times and Superluminality: a Tutorial"). Applicant respectfully traverses these rejections as well.

Claims 1 to 10 and 13 to 16 are directed to an apparatus for measuring the tunneling time of a wavepacket comprising:

> a transmission source for generating a wavepacket, the wavepacket comprising a wavefront component;
>
> a signal controller for generating a signal pulse; a signal receiver for receiving the signal pulse;
>
> a selective-transmission device comprising a quantum barrier defining a transmission distance, said selective-transmission device being in signal communication

with the transmission source, the signal controller, and the receiver such that the wavepacket is transmitted to the barrier and the wavefront component of the wavepacket tunnels through the barrier and across the transmission distance to the receiver causing superluminal group velocities; and

a monitor in signal communication with the receiver for determining the centroid time for each of a plurality wavepacket peaks; and

an analyzer for computing the vector group velocity of light from the measured centroid times.

In contrast, the Chiao reference merely provides an overview of the field of photon tunneling. Nowhere does Chiao, teach, describe or even suggest and apparatus, as claimed by Applicant for measuring the tunneling time of by measuring the "centroid times" of a plurality of peaks and then relating those "centroid times" to the group velocity of said wavepacket.

Moreover, amended and new claims 12 to 18 directed to the cosmic compass and clock/calendar embodiments of the current invention further require that the analyzer compute the "cosmic microwave background Doppler redshift direction" from the "centroid times". Nowhere does the Chiao reference even mention "centroid times" or the "cosmic microwave background Doppler redshift direction", much less suggest that one could use such centroid measurements to calculate the cosmic microwave background Doppler redshift direction as required by these claims.

Accordingly, Applicants respectfully submit that in no way can Chiao be considered to anticipate the current invention. Moreover, Applicants submit that given the absence in the Chiao reference of even a suggestion of using an apparatus as

described in the current application to monitor "centroid times" to obtain the vector group velocity of light, much less the direction of the cosmic microwave background Doppler redshift, that one of skill in the art would have had no motivation, nor the necessary teaching, to construct and utilize a superluminal transmission device as claimed by Applicant.

The Examiner objected to the drawings generally under 37 CFR §1.83 for lacking labels for all of the elements therein, Applicant presumes this objection was directed to Figure 1, which is the only Figure that contains such boxes, and has amended Figure 1 to include said labels, thereby obviating this objection.

The Examiner also objected to the drawings generally under 37 CFR §1.87 as not showing all of the claimed features of the invention. Again, presumably the Examiner is referencing Figure 1, as the remaining figures provided data taken on an apparatus as shown in Figure 1. Applicants traverse this rejection. All of the relevant features of the apparatus including, a transmission source, a signal controller, a signal receiver, a selective-transmission device, and a monitor and analyzer are shown in Figure 1. If the Examiner contends that one or more features of the claimed invention are not adequately illustrated in Figure 1, Applicant respectfully requests that the Examiner point such element or elements out with particularity.

In view of the foregoing remarks, reconsideration and allowance of this application are respectfully requested. However, the Examiner is kindly requested to call the undersigned attorney if he should deem any claim presently in the application unpatentable.

Respectfully submitted,

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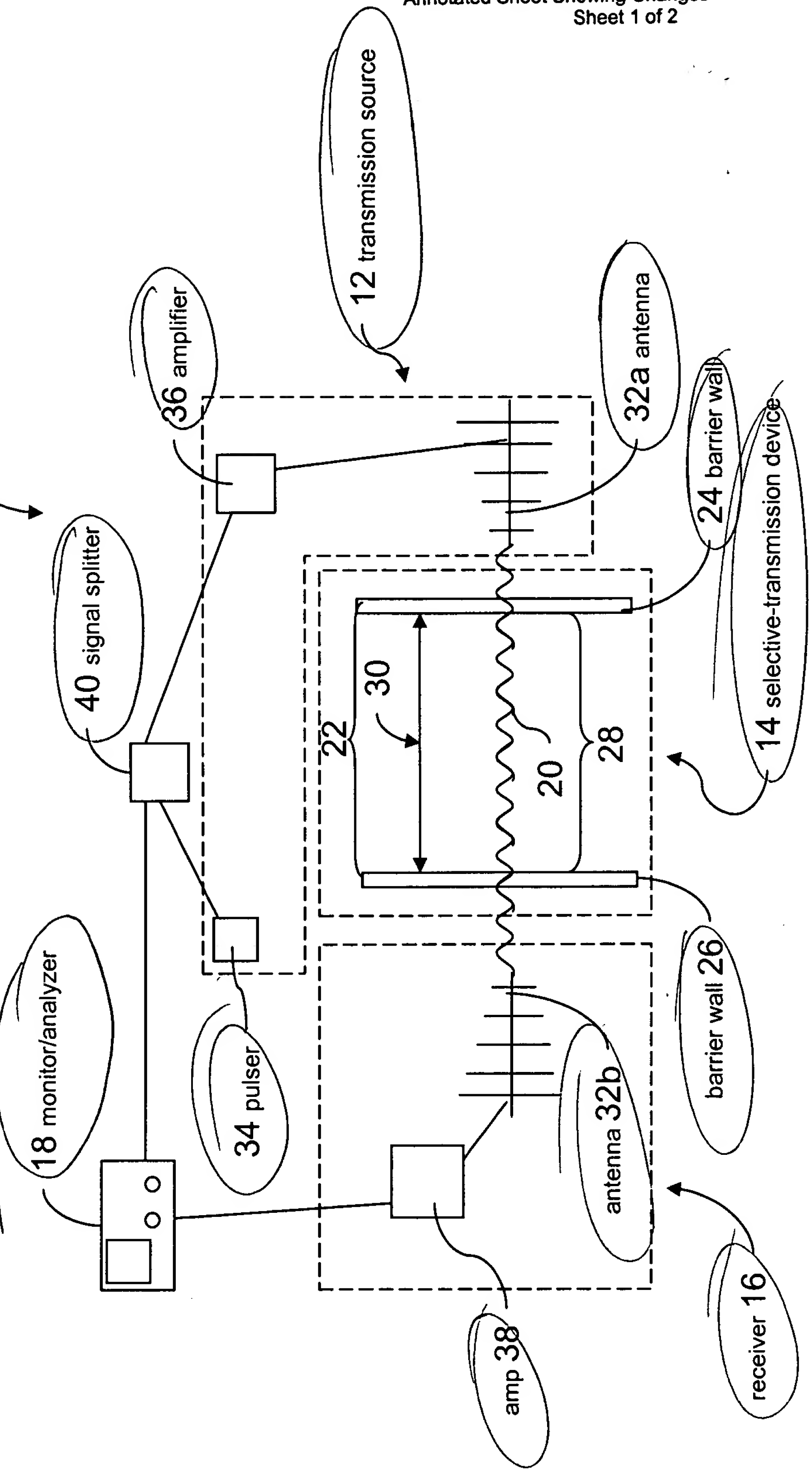
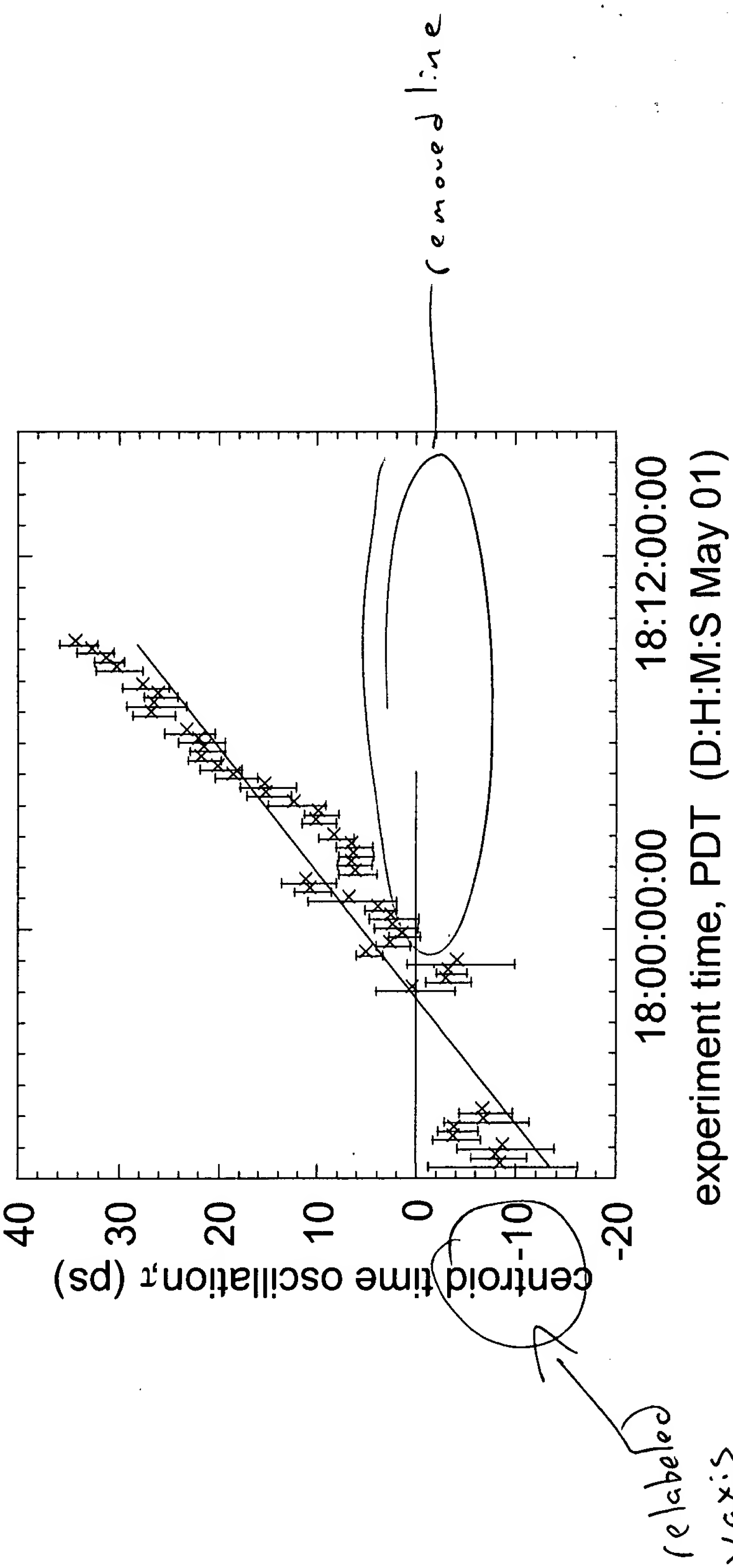
FIG. 1



Added box labels to each non labelled box

FIG. 8


removed line
40
30
20
10
0
-10
-20
centroid time oscillation,τ (ps)
18:00:00:00
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experiment time, PDT (D:H:M:S May 01)
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